Polynomial Word Problems

Name:

From 1991 through 1998, the number of commercial C and education E Internet Web sites can be modeled by the following equations, where t is the number of years since 1991. ▶ Source: Network Wizards

Commercial sites (in millions): $C = 0.321t^2 - 1.036t + 0.698$

Education sites (in millions): $E = 0.099t^2 - 0.120t + 0.295$

Find a model for the total number S of commercial and education sites.

S = total commercial + ed. sites.

$S = C + E$

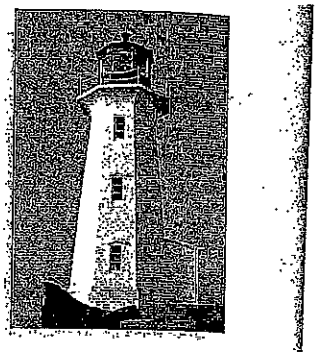
$= (0.321t^2 - 1.036t + 0.698) + (0.099t^2 - 0.120t + 0.295)$

$S = 0.420t^2 - 1.156t + 0.993$

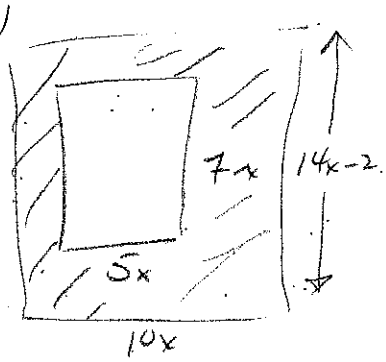
You are enlarging a 5-inch by 7-inch photo by a scale factor of x and mounting it on a mat. You want the mat to be twice as wide as the enlarged photo and 2 inches less than twice as high as the enlarged photo.

a. Draw a diagram to represent the described situation. Label the dimensions.

b. Write a model for the area of the mat around the photograph as a function of the scale factor.



a)



b) $A_{shaded} = A_{mat} - A_{photo}$

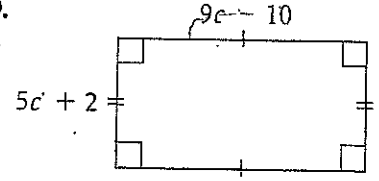
$= (10x)(14x-2) - (5x)(7x)$

$= 140x^2 - 20x - 35x^2$

$A = 105x^2 - 20x$

Geometry **Find the perimeter of each figure.**

39.

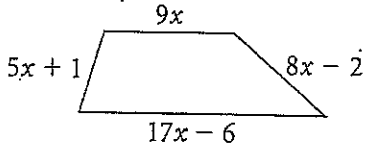


$P = 2(5c+2) + 2(9c-10)$

$= 10c + 4 + 18c - 20$

$P = 28c - 16$

40.



$P = 5x+1 + 9x + 8x-2 + 17x-6$

$P = 39x + 7$

ELECTRICAL ENGINEERS design, test, and monitor the performance of electrical equipment. This includes equipment used by power utilities to generate and transmit electricity.

ENERGY USE In Exercises 67–69, use the following information.
From 1989 through 1993, the amounts (in billions of dollars) spent on natural gas N and electricity E by United States residents can be modeled by the following equations, where t is the number of years since 1989.

▶ Source: U.S. Energy Information Administration

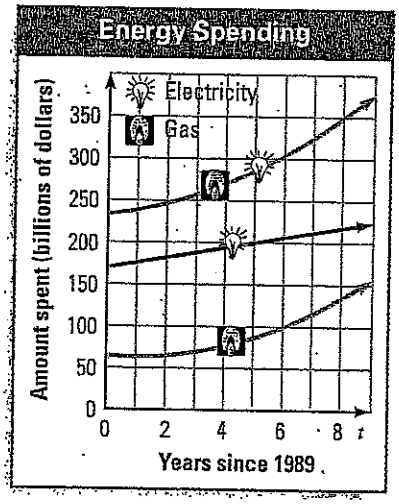
Gas spending model: $N = 1.488t^2 - 3.403t + 65.590$

Electricity spending model: $E = -0.107t^2 + 6.897t + 169.735$

67. Find a model for the total amount A (in billions of dollars) spent on natural gas *and* electricity by United States residents from 1989 through 1993.

68. According to the models, will more money be spent on natural gas or on electricity in 2020?

69. The graph at the right shows U.S. energy spending starting in 1989. Models N, E, and A are shown. Copy the graph and label the models N, E, and A.



67. Total = $N + E = 1.488t^2 + 3.403t + 65.590 - 0.107t^2 + 6.897t + 169.735$

68. natural gas $t = 31$

POPULATION In Exercises 65 and 66, use the following information.
Projected from 1950 through 2010, the total population P and the male population M of the United States (in thousands) can be modeled by the following equations, where t is the number of years since 1950.

DATA UPDATE of U.S. Bureau of the Census data at www.mcdougallittell.com

Total population model: $P = 2387.74t + 155{,}211.46$

Male population model: $M = 1164.16t + 75{,}622.43$

65. Find a model that represents the female population F of the United States from 1950 through 2010.

66. For the year 2010, the value of P is 298,475.86 and the value of M is 145,472.03. Use these figures to predict the female population in 2010.

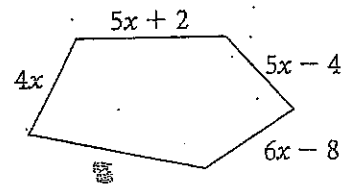
65. Female = Total − male

$= (2387.74t + 155{,}211.46) - (1164.16t + 75{,}622.43)$

66. $F = 298{,}475.86 - 145{,}472.03$

Geometry **Find each missing length.**

49. Perimeter $= 25x + 8$



$25x+8 = 4x+5x+2+5x-4+6x-8+Q$

$25x+8 = 20x-10+Q$

$5x+18 = Q$

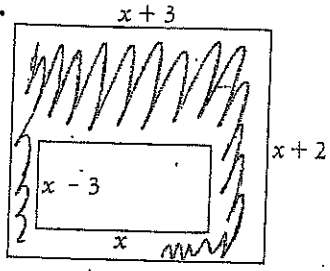
41. Error Analysis Kwan's work is shown below. What mistake did he make?

$$(5x^2 - 3x + 1) - (2x^2 - 4x - 2) = 5x^2 - 3x + 1 - 2x^2 - 4x - 2$$
$$= 5x^2 - 2x^2 - 3x - 4x + 1 - 2$$
$$= 3x^2 - 7x - 1$$

He did not change all the signs when taking the second polynomial out of parentheses

Geometry **Find the area of each shaded region. Simplify.**

20.

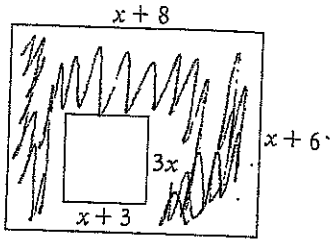


$A_{shaded} = (x+3)(x+2) - x(x-3)$

$= x^2+5x+6-x^2+3x$

$A_{shaded} = 8x+6$

21.



$A_{shaded} = (x+8)(x+6) - 3x(x+3)$

$= x^2+14x+48-3x^2-9x$

$A_{shaded} = -2x^2+5x+48$

39. Construction You are planning a rectangular garden. Its length is twice its width. You want a walkway 2 ft wide around the garden.

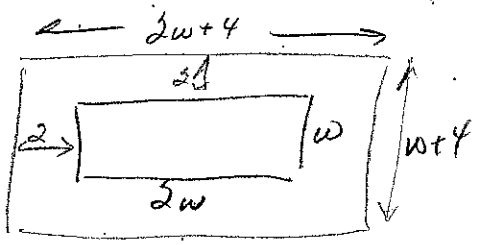
a. Write an expression for the area of the garden and walk.

b. Write an expression for the area of the walk only.

c. You have enough gravel to cover 76 ft^2 and want to use it all on the walk. How big should you make the garden?

Let w = width

$l = 2w$

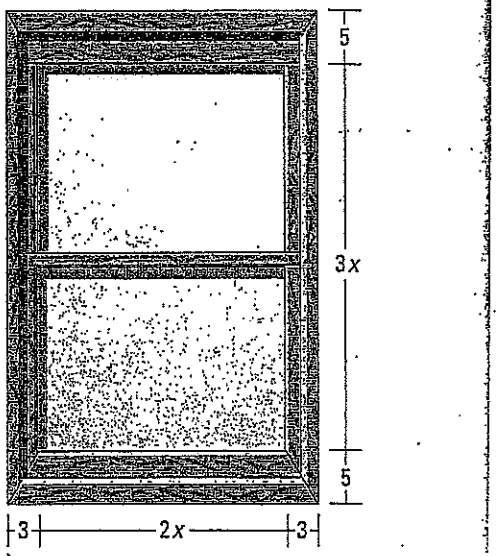


$A_{garden+walk} = (2w+4)(w+4)$

The diagram at the right shows the basic dimensions for a window. The glass portion of the window has a height-to-width ratio of 3 : 2. The framework adds 6 inches to the width and 10 inches to the height.

a. Write a polynomial expression that represents the total area of the window, including the framework.

b. Find the area when $x = 10$, 11, 12, 13, and 14.



a) $A_{TOTAL} = (3x+10)(2x+6) = 6x^2 + 38x + 60$

In Exercises 56 and 57, use the following information about videocassette sales from 1987 to 1996, where t is the number of years since 1987.

The annual number of blank videocassettes B sold in the United States can be modeled by $B = 15t + 281$, where B is measured in millions. The wholesale price P for a videocassette can be modeled by $P = -0.21t + 3.52$, where P is measured in dollars. ▶ Source: EIA Market Research Department

56. Find a model for the revenue from annual sales of blank videocassettes. Give the model as a quadratic trinomial.

57. Describe what happens to revenue during the period from 1987 to 1996.

56) Revenue = $B * P = (15t+281)(-0.21t+3.52)$

57) 1987 $t=0$
1996 $t=17$
$R(0) > R(17)$
Revenue decreases from 1987 - 1996

50. a. Vegetable Consumption Multiply the expressions on the right side of each equation to create a model for the total number of pounds of fresh vegetables $V(t)$ consumed in a year in the United States.

$C(t) = 2.7t + 165$ the U.S. annual per capita consumption of fresh vegetables, in pounds, from 1990 to 1997

$P(t) = 2.6t + 248$ the U.S. population, in millions, from 1990 to 1997

b. Evaluate the equation you found in part (a) with $t = 5$ to find the total vegetable consumption for 1995. ($t = 0$ corresponds to the year 1990.)

a) $V(t) = \frac{\text{lbs}}{\text{person}} * \text{people} = C(t) * P(t) = (2.7t+165)(2.6t+248)$